CHEMICAL IMMOBILIZATION OF SMOOTH-COATED OTTER USING A COMBINATION OF KETAMINE AND XYLAZINE HYDROCHLORIDE[1]

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Two adult and three juvenile smooth- coated otters (*Lutra perspicillata*) were anaesthetized with Hellabrunn mixture (HBM) (400 mg of ketamine hydrochloride (KHCL) and 500 mg xylazine hydrochloride (XHCL). The mean dose of HBM used was 1.04 ml/otter or 15 mg of KHCL and 18 mg of XHCL/kg body weight. Induction time varied from 3-10 minutes and the duration of anaesthesia varied from 55-90 minutes. Long duration of sedation (2-11 hours) was observed in almost all the cases which can be attributed to xylazine hydrochloride. The experiment showed that HBM provided adequate immobilization of the smooth-coated otter for surgical manipulation.

Introduction

Several drugs have been used successfully to immobilize different species of otter. William and Kochner (1978) tested five anaesthetic agents (CI744, etorphine, fentanyl, ketamine hydrochloride and halothane) to establish a safe, effective and short acting anaesthetic dosage for use in sea otter (*Enhydra lutris*). Subsequently Williams and Siniff (1983) immobilized sea otter using fentanyl in combination with azaperone. Seal and Erickson (1969) and Seal *et al.* (1970) used phencyclidine and promazine to immobilize North American river otter (*Lutra canadensis*). Kane (1979) and Melquist and Hornocker (1979a,b) immobilized North American river otter with ketamine hydrochloride (KHCL). Hoover (1984) tried KHCL in combination with xylazine and acepromazine maleate for the general anaesthesia of American river otter. Jenkins and Gorman (1981), Reuther (1983), and Reuther and Brandes (1984) used KHCL for the immobilization of European otter (*Lutra lutra*) and Kane (1979) tried KHCL on the oriental small clawed otter (*Aonyx cinerea*). Reports on the chemical immobilization of smooth-coated otter (*Lutra perspicillata*) are, however, not available.

To implant radiotelemetric devices for an ecological study of the smooth-coated otter, it was imperative to select a safe, rapid and effective anaesthetic agent that could be easily administered and produced no undesirable side effects. A mixture of 400 mg of ketamine hydrochloride (KHCL) and 500 mg of xylazine hydrochloride (XHCL) - the Hellabrunn Mixture (HBM) - was chosen in the present study considering its safety margin. This paper presents effects of HBM on smooth-coated otters.

Materials and methods

Five smooth-coated otters (3 males and 2 females) were anaesthetized using HBM. The initial anaesthetic experiment and trial implantation were carried out on a captive adult male. Subsequently, two male otters (one adult and one juvenile) and two juvenile female otters, captured by using Tomahawk and leghold live traps in the National Chambal Sanctuary (NCS), were transported 40 km north-east to the field research station of the Wildlife Institute of India at Deori in the Morena district of Madhya Pradesh for surgery. Of the four wild otters caught, two were anaesthetized and implanted with radio-transmitters within 30 hours of capture. The other two otters were held for a period of 6 weeks in a cement pool and maintained on a live fish diet till surgery.

All the animals were kept off food for 8-10 hours prior to surgery. Each animal was then anaesthetized using a Teleinject blowpipe through

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a gas pressurized syringe filled with freshly prepared Hellabrunn Mixture HBM (ketamine hydrochloride 400 mg, Ketaset, Veterinary Products, Bristol Laboratories, Syracuse, New York, + xylazine hydrochloride 500 mg dry substrate, Rompun, Bayer Leverkusen, Germany).

The initial dose for the otters was calculated based on body weight and supplementary dosages were administered intramuscularly to achieve complete anaesthesia for surgery. Following administration of HBM, clinical signs and the timing of effects of drugs were recorded. During surgery, respiratory and heart rates were checked and changes or abnormalities were noted.

Induction time was recorded as the period between administration of the drug and failure of the animal to resist when handled. In the absence of suitable methods for measuring the duration and degree of anaesthesia, duration of anaesthesia was recorded as the interval from induction to the time when the animal regained ability to resist being handled and/or reacted to external stimuli. The total duration of sedation was recorded as the time when the animal completely gained consciousness and became normal. In order to allow for the completion of surgical procedure for radio-implantation, anaesthesia was maintained for a desirable period by supplementing with additional doses when required.

Results

The mean dose of HBM required to anaesthetize was 1.04 ml/otter (± 0.143 range=0.5-1.3 ml) or 0.182 ml/kg body weight (± 0.024 ml/kg body weight, range=0.12-0.26 ml/kg) or 15 mg of KHCL and 18 mg of XHCL/kg body weight. The HBM produced immobilization and analgesia, with good muscular relaxation, adequate to perform surgery ranging from 55 to 90 minutes (Table 1).

Induction was achieved within 3-10 minutes (mean=6.4, ± 1.30 minute) after delivery of the drugs. In animals 1 and 3, a subsequent dose of 0.3 ml HBM was given intramuscularly to achieve induction. In case of animals 1 and 4, additional doses of 0.4 and 0.2 ml HBM respectively, were required to prolong the anaesthesia for completion of surgery. The duration of anaesthesia varied from 55-90 minutes (mean=68, ± 6.04 minutes). We did not find significant correlation between per kg dose of HBM and duration of anaesthesia (Spearman rank correlation, $r_s = 0.70$, $P>0.05$).

Following anaesthesia the heart rates and the respiratory rates decreased slightly, and then remained stable during surgery. In two cases slight muscular tremors were observed 10 to 15 minutes after induction and lasted for 20-30 seconds. During the anaesthesized period the eyelids remained open, muscle tone was normal and no muscular rigidity was observed at any stage. While recovering, control of the head was gained first, followed by fore and hind limbs. Otters were slightly aggressive during the early stage of recovery. Three animals urinated immediately after recovery from deep anaesthesia. On recovering from anaesthesia, the otters responded to slight noise and tactile stimuli, but they remained in a state of sedation for 2-11 hours (mean=5.4 hours, ± 1.63 hours).

However, 24 hours after surgery the captive adult male died. Necroscopy revealed that it had swallowed a piece of surgical rubber drape that had been spread in the cage, which blocked the trachea leading to asphyxiation and death.

Discussion

Ketamine has been widely used to immobilize different species of otters, but it often causes muscle rigidity that hinders surgical procedure. Some mortality during anaesthetic procedure was also reported by William and Kochner (1978). Other effects included decline in body temperature, increased salivation, convulsions, depressed respiration and cardiac stimulation [Beck *et al.* (1971), Kolata and Rawlings (1982) cited in Logan *et al.* (1986)]. Besides, the use of ketamine alone in case of otters frequently results in hyperthermia in conjunction with poor relaxation, apnoea, tachycardia and hyperexcitability during the recovery phase (Seal and Kreeger 1987).

TABLE 1
DOSAGE AND TIMED OBSERVATIONS FOR FIVE SMOOTH COATED INDIAN OTTERS IMMOBILIZED WITH HELLABRUNN MIXTURE (400 mg KETAMINE HYDROCHLORIDE + 500 mg XYLAZINE HYDROCHLORIDE)

Case	Age & sex of otters	Wt. (kg)	Initial dose (ml)	Subsequent dose (ml)	Post induction Dose (ml)	Total dose (ml)	Induction time (min.)	Duration of anaesthesia (min.)	Duration of sedation (hr)
1.	Adult male (captive)	8.00	0.5	0.3	0.4	1.2	10	55	3
2.	Juvenile female	4.00	0.5	0	0	0.5	4	65	2
3.	Sub-adult male	7.50	1.0	0.3	0	1.3	8	60	4
4.	Juvenile female	4.45	1.0	0	0.2	1.2	7	90	11
5.	Juvenile male	4.55	1.0	0	0	1.0	3	70	7
Mean		5.70	0.8			1.04	6.4	68	5.4
Standard error of mean			±.0.12			±0.14	±1.29	±6.04	±1.63

Alternatively, ketamine can be easily administered, is readily effective, has a wide margin of safety and its effects are not cumulative as those of barbiturate, therefore the doses can be frequently repeated (Ramsden *et al.* 1976, Melquist and Hornocker 1979a,b).

Ketamine when used in combination with xylazine, another central nervous system depressant that produces analgesia with sedation and muscle relaxation [Hebert and McFetridge (1981) cited in Logan *et al.* (1986)] causes reduction in salivation, muscle rigidity, emesis and convulsions (McWade 1982). To eliminate the side effects of ketamine anaesthesia, acepromazine, oxymorphine, trifluromazine and xylazine are used in fields (Amend 1972, Herbst *et al.* 1985, Logan *et al.* 1986). Apart from this the combination of KHCL and XHCL has been used to immobilize many other carnivores (e.g. Stephenson *et al.* 1978, Knight 1980, Hebert and McFetridge 1981, Parry *et al.* 1981, Nielsen *et al.* 1982, Herbst *et al.* 1985, Kreeger *et al.* 1986, Terry *et al.* 1986). These drugs usually result in smooth induction and recovery (Harthroon 1976). Thus, Seal and Kreeger (1987) recommended the use of ketamine (15 mg/kg) and xylazine (1 mg/kg) as the safe anaesthetic agent for otters. In this study we have used Hellabrunn Mixture which has a specific combination ratio (1:1.25) of ketamine and xylazine.

Xylazine often causes prolonged sedation (Parry *et al.* 1981, Hatch *et al.* 1982) that can be eliminated by using yohimbine hydrochloride, an antagonist to XHCL (Hatch *et al.* 1982, Cronin *et al.* 1983; Goldberg and Robertson 1983, Jessup *et al.* 1983). In our experiment we observed prolonged sedation (2-11 hr) that could be attributed to XHCL. The duration of sedation could have been altered at least in the fourth and fifth cases.

There is evidence that drug choice, drug dose and animal response differ among species and may vary within species (Seal and Kreeger 1987). Even though the dose/kg body weight varied considerably we did not find significant variation in duration of anaesthesia. This may be due to the small sample size and various age and sex of otters. The variation in initial drug dose in the two juvenile females appears to be due to temperament of the otters just before administration of the drugs. One of the juvenile females (case 4) was agitated when compared to the other (case 2). Both the adult males

took longer time to achieve induction compared to the juvenile male (case 5) and juvenile female (case 2). Except for longer duration of sedation no other physiological complication such as nausea, muscle rigidity, and apnoea were observed. The urination in most cases might have been due to the xylazine induced hyperglycaemia. In this study we could have reduced the long sedation period by using yohimbine, but it was not available to us.

From the experiment we conclude that Hellabrunn Mixture is a safe anaesthetic agent for otters. However, to eliminate the side effects of xylazine, yohimbine hydrochloride can be administered. Care should be taken to keep the animal preferably in a clean wooden squeeze cage avoiding surgical drapes and polyethylene sheets.

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References

Amend, J.F. (1972): Premedication with xylazine to eliminate muscular hypertonicity in cats during ketamine anaesthesia. *Vet. Med. Small Anim. Clin. 67*: 1305-1307.

Beck, C.C., R.W. Coppock & B.S. Ott (1971): Evaluation of Vetalar (ketamine HCl): A unique feline anaesthetic. *Vet. Med. Small Anim. Clin. 66*: 993-996.

Cronin, M.F., N.H. Booth, R.C. Hatch & J. Brown (1983): Acepromazine-xylazine combination in dogs: Antagonism with 4-aminopyridine and yohimbine. *American J. Vet. Res. 44*: 2037-2042.

Goldberg, M.R. & D. Robertson (1983): Yohimbine: A pharmacological probe for study of the alpha 2-adrenoreceptor. *Pharmacol. Rev. 35*: 143-180.

Harthroon, A.M. (1976): The Chemical capture of Animals. Bailliere Tindal, London, England, 416 pp.

Hatch, R.C., N.H. Booth, J.D. Clark, L.M. Crawford, Jr, J.V. Kitzman & B. Wallner (1982): Antagonism of xylazine sedation in dogs by 4-aminopyridine and yohimbine. *American J. Vet. Res. 43*: 1009-1014.

Hebert, D.M. & R.J. McFetridge (1981): Chemical immobilization of North American Game Animals. 2nd Ed. Fish and Wildlife Division, Alberta Energy and Natural Resources, Edmonton, Alberta, Canada, 250 pp.

Herbst, L.H., C. Packer & U.S. Seal (1985): Immobilization of free-ranging African Lions (*Panthera leo*) with a combination of Xylazine hydrochloride and Ketamine hydrochloride. *Journal of Wildlife disease 21(4)*: 401-404.

Hoover, J.P. (1984): Surgical implantation of radiotelemetry devices in American river otters. *J.Am. Vet. Med. Assoc., Vol. 185, No. 11*: 1317-1320.

Jenkins, D. & M.L. Gorman (1981): Anaesthesia of the European otter (*Lutra lutra*) using Ketamine hydrochloride. *J. Zool. 194*: 265-267.

Jessup, D.A., W.E. Clark, P.A. Gullet & K.R. Jones (1983): Immobilization of mule deer with ketamine and xylazine and reversal of immobilization with yohimbine. *J. Am. Vet. Med. Assoc. 183*: 1339-1340.

Kane, K.K. (1979): Medical management of the otter. *Proceedings of the Annu. Meet. Am. Assoc. Zoo Vet.* pp. 100-103c.

Knight, A.P. (1980): Xylazine. *J. Am. Vet. Med. Assoc. 176*: 454-455.

Kolata, R.J. & C.A. Rawlings (1982): Cardiopulmonary effects of intravenous xylazine, ketamine and atropine in the dog. *Am. J. Vet. Res. 43*: 2196-2198.

Kreeger, T.J., G.D. Del Guidice, U.S. Seal & P.D. Karns (1986): Immobilization of white tailed deer with xylazine hydrochloride and ketamine hydrochloride and antagonism by tolazine hydrochloride. *J. Wildl. Dis. 22*: 407-412.

Logan, K.A., E.T. Throne, L.L. Irwin & R. Skinner (1986): Immobilizing wild mountain lions (*Felis concolor*) with ketamine hydrochloride and xylazine hydrochloride. *J. Wildl. Dis. 22(1)*: 97-100.

McWade, D.H. (1982): An evaluation of ketamine and xylazine in combination as agents for the remote chemical immobilization of feral and stray dogs. In Chemical immobilization of North American Wildlife, L. Nielsen *et al.* (eds). *Wisconsin Humane Soc. Inc. Milwaukee, pp.* 175-187.

Melquist, W.E. & M.G. Hornocker, (1979a): Development and use of a telemetry technique for studying river otters. *In*: F.M. Long, Ed. Proceedings 2nd Int. Conf. Wildl. Biotelemetry, Laramie. pp. 104-114.

Melquist, W.E. & M.G. Hornocker (1979b): Methods and

techniques for studying and censusing river otter populations. Moscow, Idaho, University of Idaho. *Wildlife Range Exp. Stn. Tech. Rep. 8,* 17 pp.

NIELSEN, L., J.C. HAIGH & M.E. FOWLER (1982): Chemical immobilization of North American Wildlife. *Wisconsin Humane Soc. Inc. Milwaukee, Wisconsin,* 447 pp.

PARRY, K., S.S. ANDERSON & M.A. FEDAK (1981): Chemical immobilization of grey seal. *J. Wildl. Manage. 45*: 986-990.

RAMSDEN, R.O., P.F. COPPIN & D.H. JOHNSTON (1976): Clinical observation on the use of Ketamine hydrochloride in wild carnivores. *J. Wildl. Dis. 12*: 221-225.

REUTHER, V.C. (1983): Experiences with the immobilization of the European otter (*Lutra lutra*) with ketamine hydrochloride. *Berl Munch Tieraztl Wochenschr. 96*: 401-405.

REUTHER, V.C. & S. BRANDES (1984): Incidence of hyperthermia during immobilization of European otters (*Lutra lutra*) with Ketamine hydrochloride. *DTW. 96*: 401-405.

SEAL, U.S. & A.W. ERICKSON (1969): Immobilization of carnivora and other mammals phencyclidine and promazine. *Fed. Proc. 28*: 1410-1419.

SEAL, U.S., A.W. ERICKSON & G.J. MAYO (1970): Drug immobilization of the Carnivora. *Intern. Zoo Yearbook 10*: 157-170.

SEAL, U. & T.J. KREEGER (1987): Chemical immobilization of furbearers. *In*: Furbearer Management and Conservation in North America. Ed. M.Novak, James A. Baker, M.E. Obbard and B. Mulloch. *Pub. Ontario Trappers assoc. Ministry of Natural resources.* pp. 191-215.

STEPHENSON, J.C., D.I. BLEVINS & G.J. CHRISTAE (1978): Rompun/ Ketaset combination in dogs; a two year study. *Vet. Med. Small Anm. Clin. 73*: 303-305.

TERRY, J.K., U.S. SEAL & A.M. FAGELLA (1986): Xylazine hydrochloride-Ketamine hydrochloride immobilization of wolves and its antagonism by Tolazoline Hydrochloride. *J.Wildl. Dis. 22 (3)*: 397-402.

WILLIAM, T.D. & F.H. KOCHNER (1978): Comparison of anaesthetic agents in the sea otter. *J. Am. Vet. Med. Assoc. 173*: 1127-1130.

WILLIAM, T.D. & D.B. SINIFF (1983): Surgical implantation of radiotelemetry devices in sea otters. *J. Am. Vet. Med. Assoc. 183*: 1290-1291.